Chapter 1

HISTORY AND TRENDS

1) **Background on Foodborne Illness**

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HISTORY AND TRENDS

Introduction

Foodborne illness in the United States is a major cause of personal distress, social disruption, preventable death and avoidable economic burden. Foodborne diseases cause an estimated 24 to 81 million sporadic and outbreak-associated cases of human illness and 10,000 deaths annually in the United States. The economic impact of illness is staggering since the unpleasant symptoms of even a "mild" case of foodborne illness may require absence from school or work. Some investigators estimate that diarrheal foodborne illnesses cost from $7 to $17 billion a year in the United States. Entire industries have been crippled (i.e., economic loss) as a result of foodborne outbreaks.

1) Background on Foodborne Illness

The microbiologic hazards associated with food and food preparation are receiving increasing public attention. They are causing increasing concern not only among consumers, but also among those involved in all facets of food production and distribution. Historically, most foods were produced and consumed locally, but modern production and distribution of foods have become highly complex and involve global distribution of many kinds of fresh and processed food products. One has to merely browse the isles of the local grocery store to witness the tremendous influx of food products from throughout the world. While the benefits of the availability of such a variety of foods are many, the potential for the transmission of foodborne pathogens to large populations spread over large geographic areas also increases with modern food production and distribution.

In addition to the dangers inherent in the modern food distribution system, newly emerging or re-emerging infectious diseases influence and complicate the occurrence of foodborne illness. Transmission of a new pathogen may be poorly understood and laboratory methods for diagnosis may be difficult or unavailable. Implementation of prevention and control measures may be delayed. The 1996 and 1997 outbreaks of cyclosporiasis in the United States are examples of foodborne outbreaks caused by an emerging pathogen, *Cyclospora cayetanensis*. Approximately 1,465 individuals in 20 states were infected in 1996, and 1997 looks to be a comparable year with multiple

nationwide outbreaks reported. Since the outbreak, more has been learned about the parasite and laboratory methods of detection have become more routine.

Factors Associated With the Increase in Emerging and Reemerging Infectious Diseases

Population growth	Crowding
Changes in agriculture and food practices	Microbial evolution
Changes in ecology and climate	Modern travel
Animal migration	Animal relocation
Inadequacy of public infrastructure	Population shifts

Most foodborne illness occurs through **fecal-oral transmission**. A disease-causing organism is shed in human or animal feces and is deposited on a food item which is then eaten. A contaminated food item may result in infection if: :

1. raw food contaminated with a pathogen is not cooked long enough to kill the pathogen or is consumed raw (e.g., chicken, eggs or sushi), or
2. cooking utensils are used on a raw food contaminated with a pathogen, then the same utensils are used on another uncooked food (e.g., knife used to cut chicken is also used to cut lettuce for salad).

In addition, a non-contaminated product may become contaminated when handled by an infected food handler who failed to wash his/her hands after using the bathroom and before handling food. Any of these routes of contamination may occur in either a home setting or in a commercial operation such as a restaurant and may result in one or two cases of illness or a large number of ill individuals.

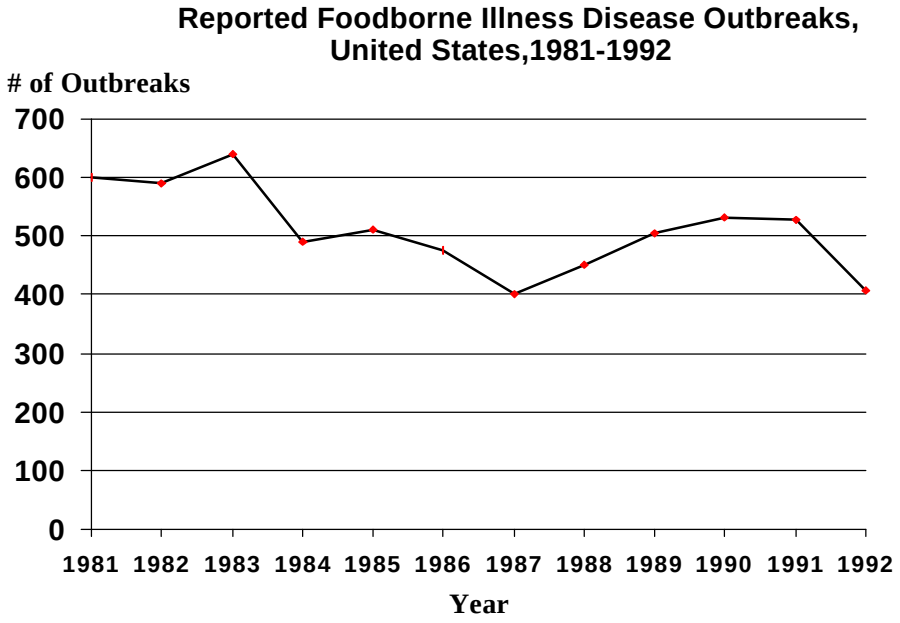
Recent outbreaks of *E. coli* O157:H7 and salmonella clearly demonstrate the potential for the amplification of a pathogen. For example, from November 15, 1992 through February 28, 1993 more than 500 laboratory confirmed infections with *E. coli* O157:H7 and four associated deaths occurred in the western United States associated with eating hamburgers from one fast food restaurant chain. In addition, it is estimated that over 200,000 people became ill in 1994 after eating a nationally distributed ice cream that was made from an ice cream premix product contaminated with *Salmonella enteritidis (SE).*

2) Foodborne Illness: A National Overview

Despite the increasing chances for transmission of pathogenic microorganisms, national data on reported outbreaks do not accurately represent the actual occurrence of disease. In fact, national data actually suggest an overall downward trend in the occurrence of foodborne outbreaks (see Figure 1.1). This is most likely attributable to reporting artifact rather than an actual decrease in decrease. With limited resources dedicated to

investigating incidents of foodborne illness, even recognizing an outbreak is becoming more difficult. Resources are limited on both the local and national level, while widespread outbreaks involving many states and even many countries are occurring with increasing frequency. Alfalfa sprouts grown from seeds contaminated with salmonella caused an international outbreak in 1995. This outbreak was only recognized because it involved a very unusual serotype of salmonella. Even then it required a large expenditure of time, energy and resources at local, national and international levels to investigate the outbreak and identify and control the source of infection. Smaller outbreaks and outbreaks caused by more common organisms may remain unidentified.

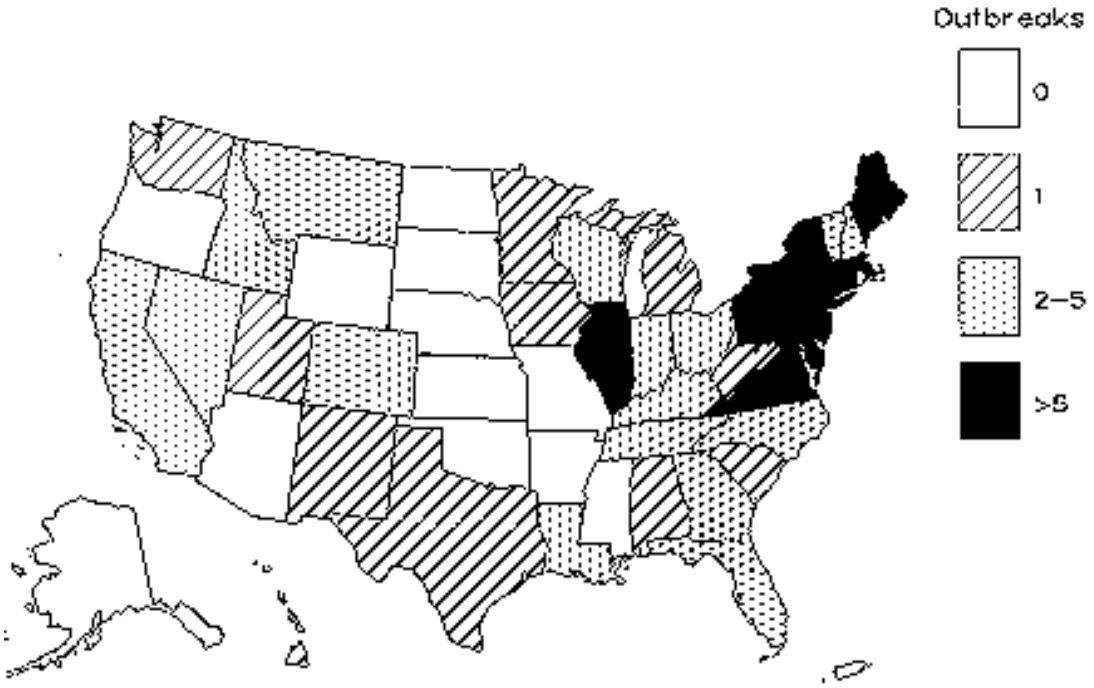
Figure 1.1



Source: CDC, MMWR 1996; SS-6

The need for resources for foodborne illness investigation at all levels cannot be overstated. A dramatic illustration was the recognition of the increased incidence of *Salmonella enteritidis* (*SE*) in the Northeast in the mid to late 1980s (see Figure 1.2). A 1988 report by the Centers for Disease Control and Prevention (CDC) reported that the national incidence of *SE* infections had increased significantly during the previous decade. Further investigation revealed a dramatic increase in *SE* in the Northeast. This increase was found to be associated with consumption of whole shell eggs or foods containing shell eggs. Further analysis revealed that the increase in *SE* cases in the Northeast had actually begun around 1984 (see Figure 1.3).

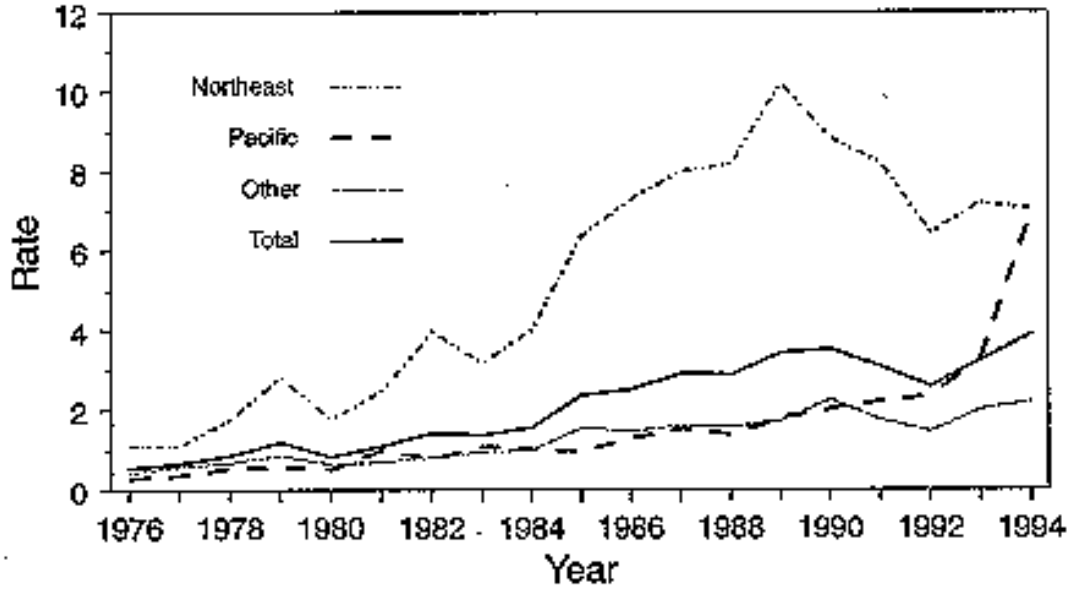
FIGURE 1.2
Reported Outbreaks of S. enteritidis
United States 1985–1991



Data from Mishu et al, J Inf Dis, 1994.

Figure 1.3

Rate* of Isolation of *Salmonella* serotype Enteritidis by Region and Year - United States, 1976-1994



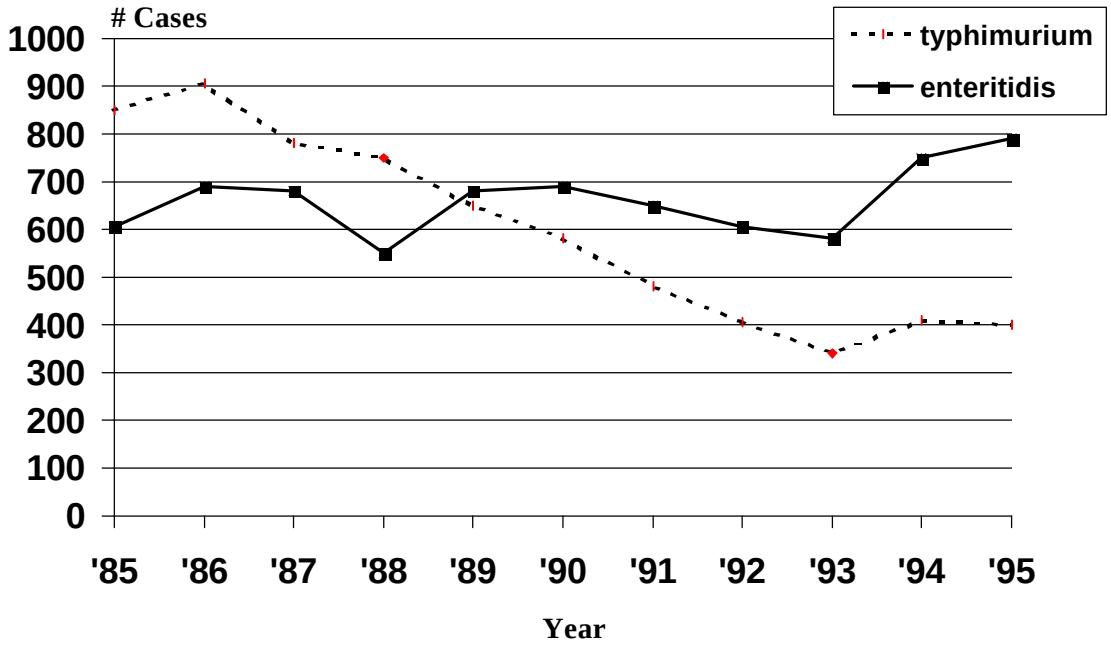
*Per 100,000 population.

Source: CDC, MMWR, August 30, 1996, Vol. 45, No. 34.

In Massachusetts the increase in occurrence of *SE* infection became strikingly clear when in 1989 *SE* infections surpassed *S. typhimurium* infections. Until 1989, *S. typhimurium* was the leading serotype of salmonellosis in Massachusetts (see Figure 1.4). From 1989-1992 *SE* accounted for the most foodborne outbreaks, cases, and deaths, with the majority of cases associated with eating raw or undercooked eggs. The recognition of eggs as an important source of disease had dramatic local, regional and national ramifications. Producers, distributors, cooks and consumers of chicken and egg products were affected. Stricter controls, from refrigeration during distribution to adequate cooking, have prevented much illness. The changing epidemiology of *Salmonella* infections would not have been recognized without national and local capacity for investigation.

Figure 1.4

Common Salmonella Serotypes,
Massachusetts Reported Cases, 1985-1995



Source: MDPH, Working Group on Foodborne Illness Control, 1995

In addition, resources for laboratory investigations are necessary. Laboratory testing for many foodborne pathogens is difficult and in some cases non-existent. Testing methods for certain parasites and viruses are difficult and often unavailable. Also, testing for staphylococcal, *Bacillus cereus* or *Clostridium perfringens* toxins is not commonly performed. Consequently, laboratory confirmation of the causative organism is not available for over half of the foodborne disease outbreaks reported to the CDC.

In addition to the common causes of foodborne illness, nationwide outbreaks of "new" pathogens are also being identified. As mentioned previously, the 1996 and 1997 nationwide outbreaks of infection due to the parasite *Cyclospora cayetanensis* were recognized. For both years, the primary vehicle of infection was raspberries imported from outside this country.

Despite increasing competition for resources at all levels, the number of foodborne disease outbreaks reported to the CDC per year did not change substantially from 1988 to 1991. In 1992 however, the CDC revised part of its definition of a foodborne outbreak

resulting in a decline in the number of reported outbreaks. Prior to 1992, one person intoxicated by *Clostridium botulinum* toxin was considered an outbreak. In 1992, two or more cases of intoxication by *C. botulinum* toxin have been required to constitute an outbreak. (Note that one case of botulism in Massachusetts would elicit an in-depth investigation.)

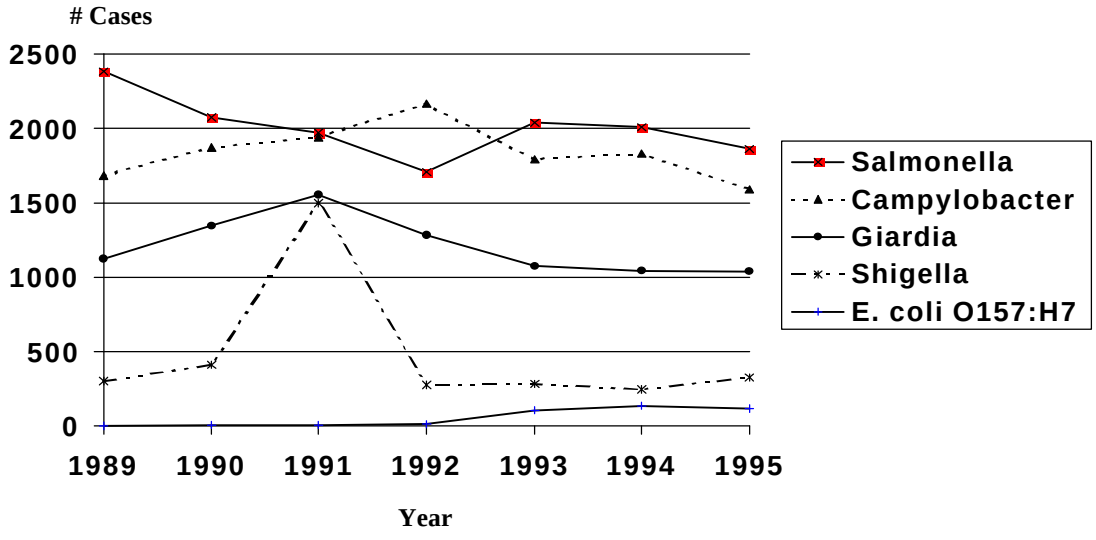
Continued surveillance of disease at a national level is imperative and will be achieved only through continued surveillance at state and local levels. The following section will summarize the occurrence of foodborne illness in Massachusetts.

3) Foodborne Illness: A Massachusetts Overview

During the last seven years the number of cases of enteric illness reported to the MDPH by local BOH, laboratories and others has remained fairly constant (see Figure 1.5). The large increase in Shigella cases in 1991 was due to an outbreak of shigellosis in the Springfield area in which over 1,000 cases resulted from person-to-person transmission primarily among children. Salmonella, the most commonly reported enteric pathogen, continues to be a large problem with over 1800 cases reported in 1995 (see Figure 1.5). The incidence of *SE* has been increasing since the mid 1980s when it was discovered that eggs distributed in the Northeast were contaminated with *SE*.

Figure 1.5

Cases of Reported Enteric Illness, Massachusetts, 1989-1995



Source: MDPH, Working Group on Foodborne Illness Control, 1995

Both *E. coli* O157:H7 and hemolytic uremic syndrome (HUS) were added to the Massachusetts list of reportable diseases in August 1994. (A copy of the Massachusetts *Diseases Reportable by Healthcare Providers* follows Chapter 4.) Cases of *E. coli* O157:H7 and HUS had been reported sporadically (by local BOH, laboratories and others) to the MDPH Surveillance Unit since 1988.

An outbreak of *E. coli* O157:H7 occurred in 1991 and was associated with the consumption of locally produced apple cider made with unwashed and unbrushed apples. This outbreak was recognized when four children from southeastern Massachusetts were admitted to a Boston children's hospital with HUS between October 23 and November 20, 1991. (HUS is a severe and sometimes fatal result of *E. coli* O157:H7 infection.) The subsequent investigation identified 23 additional individuals with *E. coli* O157:H7 infection and the cause of the outbreak. Another *E. coli* O157:H7 outbreak occurred in 1995 and was associated with the consumption of foods containing ground beef from a Mexican food stand at a county fair. (For more information on HUS, see Chapter 2, Section 3-C.)

Collecting information and tracking reportable foodborne diseases or conditions is a difficult undertaking. Most of these illnesses resolve within 24-48 hours with the person never seeking medical attention. And even when a health care provider is consulted, laboratory testing is not always performed. The lack of testing is becoming more prevalent with the growth of managed care. The task becomes even more difficult when an illness or syndrome is caused by a pathogen that is "emerging," i.e., not widely known or newly recognized as causing illness. Frequently these new diseases are not on the list of reportable diseases and conditions, and the MDPH is therefore unlikely to be notified. This occurred during the 1996 nationwide outbreak of *Cyclospora* infection that was thought to be caused by the consumption of contaminated fresh berries. When the first cases of the outbreak were identified the MDPH requested that labs report infection of *Cyclospora*. Within two months of the first report, the MDPH had learned of over 80 sporadic cases and a similar number associated with group events in Massachusetts.

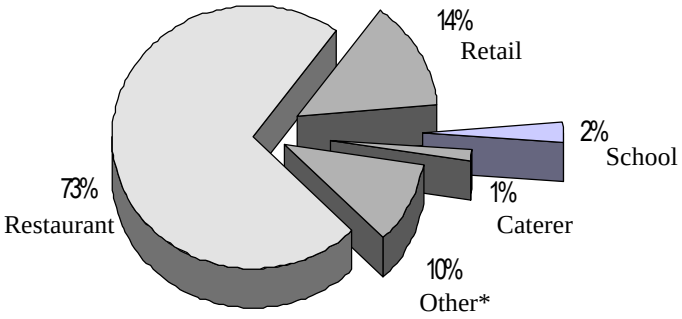
One of the main purposes of the MDPH Working Group on Foodborne Illness Control (WGFIC) is to track cases and complaints of foodborne illness. The earlier problems are recognized, the quicker control measures may be implemented and additional cases of illness prevented. For this reason, it is important to track consumer complaints and review the data periodically for clusters of illness or changes in trends of illness. Changes in the occurrence of disease compared to previous time periods may necessitate further investigation.

NOTE: See Chapter 4, Sections 3 and 6 for more information on tracking consumer complaints at the local level and using the information collected. See Chapter 5 for further information on pursuing foodborne illness investigations.

Information collected on consumer complaints can also be used to identify areas in need of improvement. In 1996 approximately 73% of foodborne illness *complaints* by the WGFIC in Massachusetts involved restaurants, while 1% were associated with caterers (see Figure 1.6). When foodborne illness *cases* are analyzed by establishment type, however, 38% of cases involved catered food (see Figure 1.7). This information illustrates that while outbreaks at catered events are less common, larger numbers of people are affected. Caterers may prepare large amounts of food for large groups, under conditions that are not always ideal. This information is useful for designing foodborne illness control programs or modifying existing ones. Thoughtful analysis of surveillance data allows the identification of areas of concern and is useful in planning.

Figure 1.6

Foodborne Illness *Complaints* by Establishment Type, Massachusetts: 1996

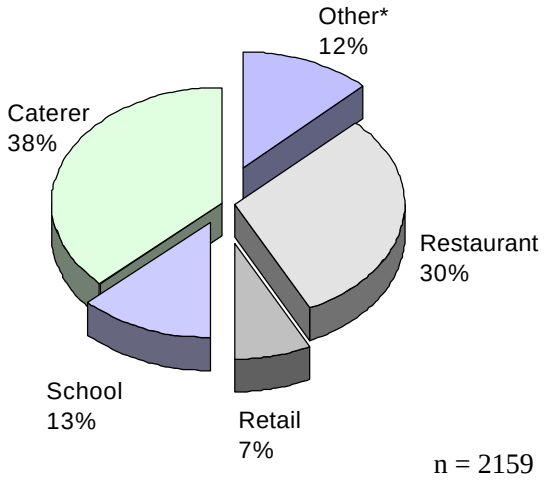


n = 411

Source: MDPH, Working Group on Foodborne Illness Control, 1996
* "Other" category includes nursing homes, private homes and mobile food vendors

Figure 1.7

Foodborne Illness *Cases* by Establishment Type, Massachusetts: 1996



Source: MDPH, Working Group on Foodborne Illness Control, 1996
* "Other" category includes: nursing homes, private homes and mobile food vendors

Foodborne illness surveillance, with accurate and complete documentation, is necessary at local, state, national and international levels. Food is often imported and exported. Raspberries are imported from Guatemala and people all over the world use maple syrup from Vermont. We must always be aware of what is happening now and what has happened in the past in order to develop effective strategies for preventing foodborne and waterborne illness.

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